



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/912,495	07/24/2001	Steve Ghanayem	5049	6265

32588 7590 04/01/2003

APPLIED MATERIALS, INC.  
2881 SCOTT BLVD. M/S 2061  
SANTA CLARA, CA 95050

EXAMINER

MEEKS, TIMOTHY HOWARD

ART UNIT	PAPER NUMBER
----------	--------------

1762

DATE MAILED: 04/01/2003

4

Please find below and/or attached an Office communication concerning this application or proceeding.

46

# Office Action Summary

Application No.

09/912,495

Applicant(s)

GHANAYEM ET AL.

Examiner

Timothy H. Meeks

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 24-27 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-27 are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 6) ☐ Other:

## DETAILED ACTION

### *Election/Restrictions*

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-23, drawn to a method, classified in class 438, subclass 632.
- II. Claims 24-27, drawn to an apparatus, classified in class 118, subclass 724.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the method could be performed by an apparatus not having a memory coupled thereto.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Mr. Michael Bernardicou on November 19, 2002 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-23. Affirmation of this election must be made by applicant in replying to this Office action. Claims 24-27 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the

Art Unit: 1762

currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

### ***Drawings***

The corrected or substitute drawings were received on 05 September 2001. These drawings are approved.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

There is confusing as to the metes and bounds of the phrase "high concentration borophosphosilicate glass". Applicants define this phrase at paragraph 0056 as a BPSG film having boron concentration of approximately 2-7 wt%, a phosphorus concentration of approximately 2-9 wt%, and combined boron and phosphorus content of about 10-12 wt%. However, given this definition, claims 3, 4, 13, and 14 would be improper dependent claims as they would fail to further limit the independent claims and it is believed that applicants would not intentionally file improper dependent claims. For the purposes of the art rejections below, the phrase "high concentration borophosphosilicate glass" is given the definition stated by applicants at paragraph 0056. Applicants are requested to amend the claims so as to more clearly

Art Unit: 1762

define the phrase or amend the above-listed dependent claims so as to render them further limiting.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-8 and 12-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Yang (6,656,556).

The claimed process is explicitly disclosed at col. 3, lines 8-20, 35-40, and 45-50, col. 5, lines 5-45, and col. 6, lines 40-55. Please note that the endpoints of the ranges of boron and phosphorus amounts in the second and fourth BPSG layers fall into the claimed ranges for boron, phosphorus, and total dopant concentrations and hence are anticipatory thereof. With respect to claim 2, Yang moves the substrate to a plasma etcher following the BPSG reflow step which would necessarily involve at least some cooling of the substrate as it is moved. With respect to claims 12-15, please note that it is not required that the claims be performed in the sequence listed, therefore, the undoped silica deposition step of Yang meets the claim limitations.

Claims 1-6, 12-15, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu et al. (5,094,984).

The claimed process is explicitly disclosed at col. 4, lines 5-15, col. 6, lines 50-65, col. 8, line 66 to col. 9, line 4, , col. 9, line 67 to col. 10, line 2, and col. 10, lines 59-63. Please note that

Art Unit: 1762

the endpoints of the ranges of boron and phosphorus amounts in the BPSG layers fall into the claimed ranges for boron, phosphorus, and total dopant concentrations and hence are anticipatory thereof. With respect to claim 2, analysis are performed on the annealed layers which would necessarily require cooling the substrate after the annealing and before the analysis.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yieh et al. (5,994,209).

Yieh et al. disclose the deposition of a PMD BPSG dielectric layer having about 2-6 wt% boron and 2-9 wt% phosphorus comprising flowing TEOS, ozone, TEB, and TEPO into a reactor having a semiconductor substrate under the claimed deposition conditions for pressure, flow rate, deposition rate, and temperature (col. 49, lines 20-65). The concentration ranges of boron and phosphorus are inclusive of the claimed total boron and phosphorus amounts and hence use of the claimed values would have been expected to be operable.

Yieh does not explicitly disclose reflowing the BPSG layer in particular. However, Yieh discloses at col. 3, lines 18-20 that the PMD dielectric materials need good gap fill capability in large trenches with high aspect ratios, that the dielectric layers may be heated at temperatures greater than 500 °C for planarization (col. 7, lines 55-60), and that for use as a PMD layer formed over high aspect ratio transistors or isolation trenches, the doped dielectric film requires

Art Unit: 1762

planarization by reflowing at temperatures of 750-850 °C after stooping deposition of the dielectric layers (i.e., dry atmosphere) (col. 53, lines 25-60), it would have been obvious to have heat treated the BPSG of Yieh when use thereof is as a PMD on high aspect ratio transistors or isolation trenches so as to achieve the desired planarization thereof described by Yieh.

Yieh further discloses that a capping layer of undoped silica glass can be deposited on a doped dielectric layer to avoid moisture absorption and exemplify the process thereof with BSG or PSG (col. 51) but do explain at col. 50 that the methods described are equally applicable to any doped silicon oxide film. As such, it would have been obvious to form such undoped silica capping layer on the BPSG layers to improve its moisture resistance.

Claims 9-11 and 16-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yang in view of Yieh et al.

Yang does not disclose the claimed BPSG deposition. However, because Yieh describes these deposition conditions appropriate for forming a BPSG layer for a PMD application (see above), it would have been obvious to use these conditions to achieve a BPSG layer appropriate for PMD application.

Claims 7-11 and 16-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. in view of Yieh et al.

Liu does not disclose the claimed BPSG deposition. However, because Yieh describes these deposition conditions appropriate for forming a BPSG layer for a PMD application (see

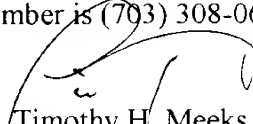
Art Unit: 1762

above), it would have been obvious to use these conditions to achieve a BPSG layer appropriate for PMD application.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy H. Meeks whose telephone number is (703) 308-3816. The examiner can normally be reached on Mon, Tue, and Thu, 6:00-6:30, and Sun, 6-10 am.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive P. Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



Timothy H. Meeks  
Primary Examiner  
Art Unit 1762

nf  
March 30, 2003